Softelec

Free Electronic & Software Design

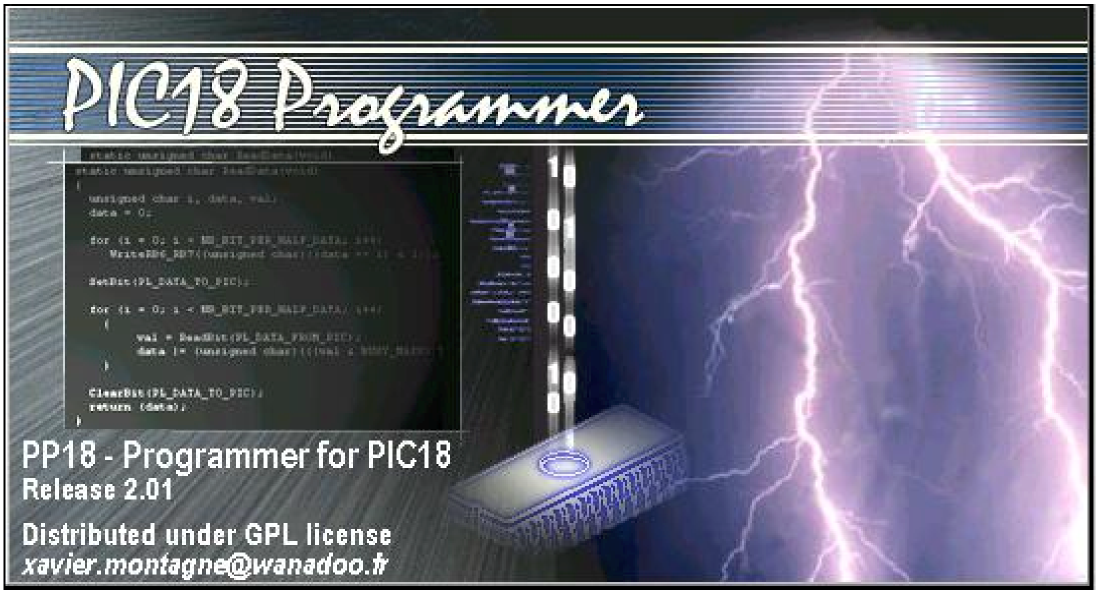
PP18 v2.01

PIC18 Software Programmer

User & Developer Guide

2003, October 20th – Rev 1.00

TO ANY PP18 USER



```
static unsigned char ReadData(void)
{
  unsigned char i, data, val;
  data = 0;

  for (i = 0; i < NB_BIT_PER_HALF_DATA; i++)
    WriteRB6_RB7((unsigned char)((data >> i) & 1))

  SetBit(PL_DATA_TO_PIC);

  for (i = 0; i < NB_BIT_PER_HALF_DATA; i++)
   {
        val = ReadBit(PL_DATA_FROM_PIC);
        data |= (unsigned char)((val & BUSY_BIT
   }

  ClearBit(PL_DATA_TO_PIC);
  return (data);
}
```

PP18 - Programmer for PIC18
Release 2.01
Distributed under GPL license
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Table of content

1 APPLICATION OVERVIEW

1.1 Presentation

PP18 is freeware, which programs any PIC in the Microchip PIC18 family. It is distributed under GPL licence.

PP18 offers a Graphical User Interface to access the PIC18 memory easily. The application is separated in 2 parts:

- A window common to every PIC18 managed by the application.
- A specific DLL (Dynamic Loaded Library) for each PIC in the PIC18 family.

PP18 is running properly under any 32-bit version of Microsoft Windows.
PP18 should be ported to Linux, but this release does not yet run under "Unix like" operating systems.

1.2 Current release

The current release is the 2.01. The previous version (1.00) of PP18 was not able to program any PIC18, but just PIC18F452 chip. The 1.00 version has validated the PIC18 access through a parallel port.

The release 2.00 is based on an interface in-between the main window and the DLL in order to manage each PIC18 specifically. Indeed Microchip does not use the same access protocol for every PIC in the PIC18 family.

1.3 Supported devices

The devices supported by the PP18 release 2.00 are:

	Available	Tested
PIC18F242	YES	YES
PIC18F248	YES	NO
PIC18F442	YES	YES
PIC18F448	YES	NO
PIC18F252	YES	YES
PIC18F258	YES	NO
PIC18F452	YES	YES
PIC18F458	YES	YES
PIC18F1220	NO	NO
PIC18F1320	YES	YES
PIC18F2220	NO	NO
PIC18F2320	NO	NO
PIC18F2331	NO	NO
PIC18F2431	NO	NO
PIC18F4220	YES	YES
PIC18F4320	NO	NO
PIC18F4331	NO	NO
PIC18F4431	NO	NO
PIC18F6520	YES	NO
PIC18F6620	YES	YES
PIC18F6720	YES	YES
PIC18F6680	NO	NO
PIC18F8520	NO	NO
PIC18F8620	NO	NO
PIC18F8720	YES	NO
PIC18F8680	NO	NO
PIC18C242 JW/OTP	NO	NO
PIC18C248 JW/OTP	NO	NO
PIC18C442 JW/OTP	NO	NO
PIC18C448 JW/OTP	NO	NO
PIC18C252 JW/OTP	NO	NO
PIC18C258 JW/OTP	NO	NO
PIC18C452 JW/OTP	NO	NO
PIC18C458 JW/OTP	NO	NO
PIC18C1220 JW/OTP	NO	NO
PIC18C1320 JW/OTP	NO	NO
PIC18C2220 JW/OTP	NO	NO
PIC18C2320 JW/OTP	NO	NO
PIC18C2331 JW/OTP	NO	NO
PIC18C2431 JW/OTP	NO	NO
PIC18C4220 JW/OTP	NO	NO
PIC18C4320 JW/OTP	NO	NO
PIC18C4331 JW/OTP	NO	NO
PIC18C4431 JW/OTP	NO	NO
PIC18C6520 JW/OTP	NO	NO
PIC18C6620 JW/OTP	NO	NO
PIC18C6720 JW/OTP	NO	NO
PIC18C6680 JW/OTP	NO	NO
PIC18C8520 JW/OTP	NO	NO
PIC18C8620 JW/OTP	NO	NO
PIC18C8720 JW/OTP	NO	NO
PIC18C8680 JW/OTP	NO	NO

For each PIC18 supported there is a specific DLL located on the web site of PP18. The DLL filename is the one of the device.

1.4 Supported programmers

PP18 is designed to access PIC18 through any peripheral because this job is done by the DLL. Elsewhere the PIC18 device needs only 5 signals to be programmed:

- **VCC**
- **VPP**
- **DATA TO PIC**

- **DATA FROM PIC**
- **CLOCK**

It is recommended to use SCHAER and SCHAER+ programmers through LPT port. All the free DLL proposed with PP18 have to be used with SCHAER type programmer.

The SCHAER+ programmer is a hardware derived from the famous SCHAER programmer designed to access the PIC16F84 through the parallel port.

The SCHAER+ version is able to manage the 5 signals described above. It exists in a version with ZIF 40 pins socket to program PDIP chips and an ICSP version to program the chip from the PCB itself.

Visit the following web site to get more information related to SCHAER+ programmer:
http://perso.wanadoo.fr/softelec

1.5 Performance

PP18 is really fast software, capable of programming the entire memory (code, configuration bits and ID), reading all the fields programmed and computing the corresponding checksum in less than 10 seconds in case of maximum speed settings (32 Kb target).

To do so PP18 uses a DIRECT IO method to address the LPT port of the PC. The application accesses directly the IO address even on protected Windows platforms, thanks to ALLOWIO.exe program from www.beyondlogic.org.

2 INSTALLATION PROCEDURE

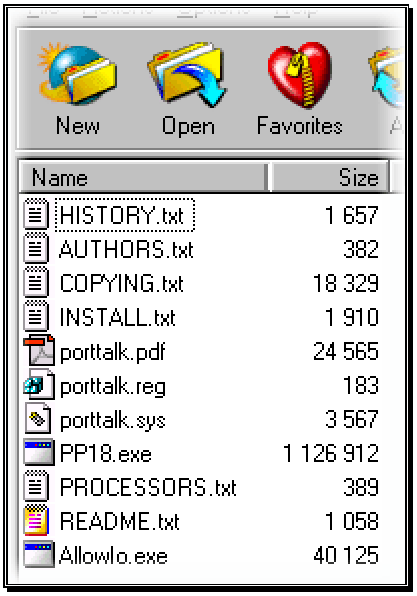
2.1 Minimum configuration

The minimum configuration required is an i386 processor with 8 Mbytes of memory, and Microsoft Windows.

Tests have been done with a Intel Celeron processor at 400 MHz with 128 Mbytes of RAM. Windows 98 and Borland Builder 3.0 have been chosen for validation and development.

2.2 ZIP file content

Here is a screenshot of the ZIP file content:



Name	Size
HISTORY.txt	1 657
AUTHORS.txt	382
COPYING.txt	18 329
INSTALL.txt	1 910
porttalk.pdf	24 565
porttalk.reg	183
porttalk.sys	3 567
PP18.exe	1 126 912
PROCESSORS.txt	389
README.txt	1 058
AllowIo.exe	40 125

2.3 W95 / W98 installation

To run PP18 under Windows 95 or 98 you don't need any special installation.

At the first run, the application will look up the register of Windows to create a new key. This key contains all the settings of PP18:

- Path for HEX file
- Path for DLL
- Current release of PP18
- DelayIO value
- Settings of the programmer

Every time you run PP18 the application will look up the key to take into account the last settings.

2.4 W2000/ NT / XP installation

Because Windows 2000, NT or XP need kernel privileges to access directly the IO addresses, PP18 is not authorized to write and read through the LPT port (PP18 is running with application privileges).

So it's necessary to use a kind of bridge to allow an application to access a resource via the bridge. This is the job of a driver. To get the same effect without developing any driver, we can use ALLOWIO.exe program developed by www.beyondlogic.org.

To execute PP18 under Windows 2000, NT or XP open a DOS window and find the directory where PP18_v2_00.zip has been extracted.
Type "Allowio 0x378 PP18.exe" which permits PP18 to freely access the LPT 1 (0x378), and then runs PP18.

For a more comfortable use create a batch file in which you'll insert the previous command line.

2.5 Windows Registry

All the PP18 settings are stored in the Registry in order to facilitate the reuse of the application.

The key manipulated by PP18 is located at:

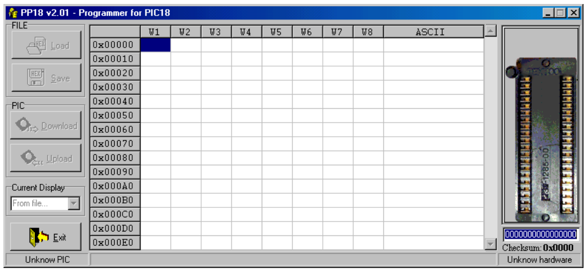
HKEY_CURRENT_USER/Software/PP18

To not disturb PP18 process it is mandatory to not modify the values of this key. You can read or copy the content of the key, but never change it.

In case any value has been changed, terminate the PP18 application, delete the entire PP18 key from the Registry and launch PP18. This will generate a new PP18 key.

3 PP18 USER GUIDE

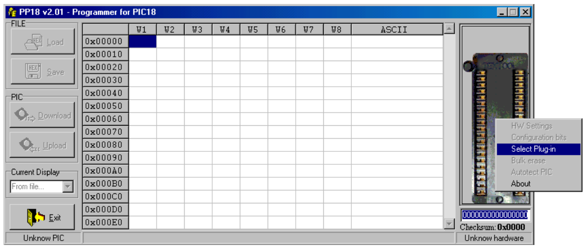
We suppose you have correctly installed PP18 on your Windows platform.



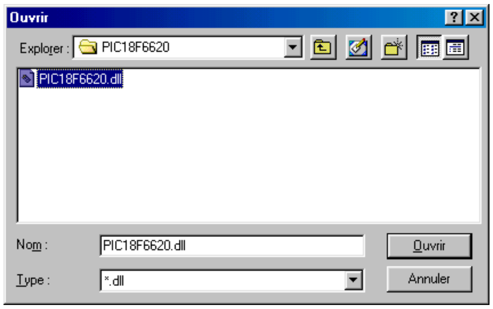
PP18 runs as a single window, non sizeable with just the EXIT button enabled.

3.1 Select DLL

By putting the mouse above the ZIF image (Zero Insertion Force) at the right side of the window, the icon should change to a hand. Right click to display a POPUP menu, and choose the SELECT PLUG-IN item.



Navigate through the window opened to find the directory where the PIC18 specific DLLs are located. Then select the DLL corresponding to the device you have inserted into the programmer.



Explorer : PIC18F6620

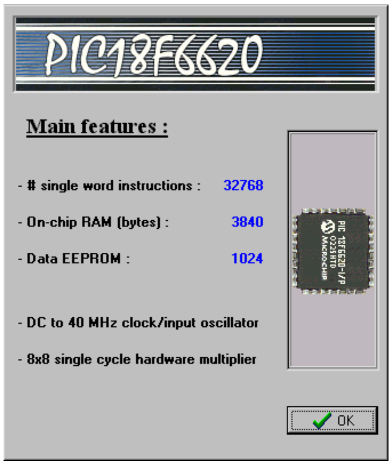
PIC18F6620.dll

Nom : PIC18F6620.dll

Type : *.dll

3.2 About the DLL

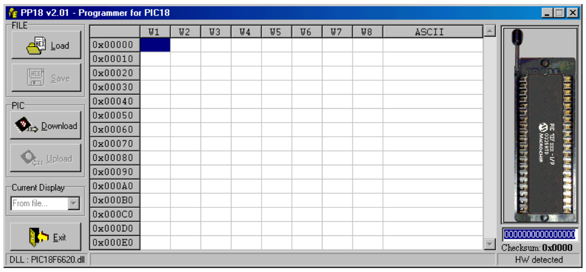
If the selected DLL interface is recognized by the main application a new modal windows appears showing a picture and the name of the PIC18 managed by the DLL.



Main features :

- # single word instructions : 32768
- On-chip RAM (bytes) : 3840
- Data EEPROM : 1024
- DC to 40 MHz clock/input oscillator
- 8x8 single cycle hardware multiplier

Click on the OK button to accept the DLL. If you want to change to a different DLL, close the window by clicking on the OK button, then select another DLL from the ZIF image of the main window.



DLL : PIC18F6620.dll

HW detected

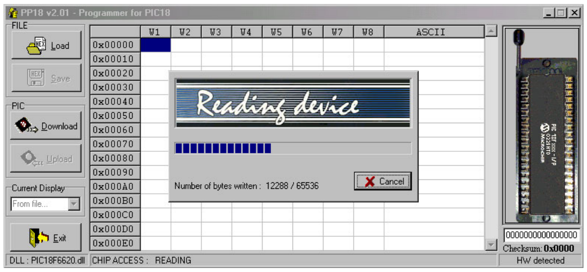
This DLL expects to find this chip on the hardware programmer and then will try to make an automatic detection of this device.

The hardware detection result is displayed in the right-hand side of status bar and the DLL filename loaded is displayed at the left side of the status bar.

3.3 Download from PIC

If you have inserted a blanked PIC18 into the hardware programmer, you should get a new image at the ZIF location: the image depicts a generic PIC18Fxxx device inserted into the ZIF.

The picture is generic means it does not look exactly the same as the PIC18 itself. Only the DLL is able to show a representative view of the PIC18 manipulated.



```
          W1   W2   W3   W4   W5   W6   W7   W8   ASCII
0x00000
0x00010
0x00020
0x00030
0x00040
0x00050
0x00060
0x00070
0x00080
0x00090
0x000A0
0x000B0
0x000C0
0x000D0
0x000E0
```

Number of bytes written : 12288 / 65536

0000000000000000
Checksum: 0x0000

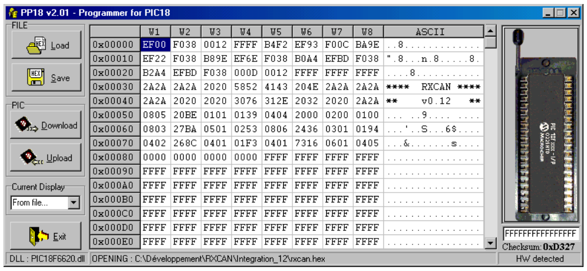
DLL : PIC18F6620.dll | CHIP ACCESS : READING | HW detected

Now that the PIC18F of your choice has been detected by the DLL, the DOWNLOAD and LOAD buttons are enabled.

Click on the DOWNLOAD button to read the content (Memory + configuration bits + ID) of the PIC18. If your device is really blanked (each memory byte is equal to 0xFFFF), then a message box appears telling you the PIC18 is blanked.

3.4 Open an HEX file

Click on the LOAD button to open a modal selection file window. Select an HEX file such as those generated by Microchip MPLAB.



```
          W1   W2   W3   W4   W5   W6   W7   W8   ASCII
0x00000   EF00 F038 0012 FFFF B4F2 EF93 F00C BA9E ..8.............
0x00010   EF22 F038 B89E EF6E F038 B0A4 EFBD F038 ".8...n.8.....8.
0x00020   B2A4 EFBD F038 000D 0012 FFFF FFFF FFFF ....8...........
0x00030   2A2A 2A2A 2020 5852 4143 204E 2A2A 2A2A ****   RXCAN ****
0x00040   2A2A 2020 2020 3076 312E 2032 2020 2A2A **      v0.12   **
0x00050   0805 20BE 0101 0139 0404 2000 0200 0100 ... ..9.... ....
0x00060   0803 27BA 0501 0253 0806 2436 0301 0194 ...'..S...6$....
0x00070   0402 268C 0401 01F3 0401 7316 0601 0405 ...&.......s....
0x00080   0000 0000 0000 0000 FFFF FFFF FFFF FFFF ................
0x00090   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000A0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000B0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000C0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000D0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000E0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
```

FFFFFFFFFFFFFFFF
Checksum: 0xD327

DLL : PIC18F6620.dll | OPENING : C:\Développement\RXCAN\Integration_12\rxcan.hex | HW detected

A new content is displayed in the central grid without deleting the previous content from the PIC18 inserted. To switch from PIC to FILE view you have to use the CURRENT DISPLAY combo box.

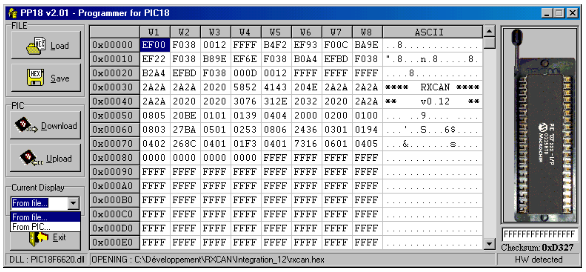
3.5 Save an HEX file as

Click on the SAVE button to convert all the data (memory + configuration bits + ID) specified by the CURRENT DISPLAY combo box into an HEX file.

All the code memory is stored in the destination file, even if the code contains only 0xFFFF values.

3.6 Select the current display

The CURRENT DISPLAY combo box allows you to change the content of the central grid to the one from either the PIC or the FILE.



```
          W1   W2   W3   W4   W5   W6   W7   W8   ASCII
0x00000   EF00 F038 0012 FFFF B4F2 EF93 F00C BA9E ..8.............
0x00010   EF22 F038 B89E EF6E F038 B0A4 EFBD F038 ".8...n.8.....8.
0x00020   B2A4 EFBD F038 000D 0012 FFFF FFFF FFFF ....8...........
0x00030   2A2A 2A2A 2020 5852 4143 204E 2A2A 2A2A ****   RXCAN ****
0x00040   2A2A 2020 2020 3076 312E 2032 2020 2A2A **      v0.12   **
0x00050   0805 20BE 0101 0139 0404 2000 0200 0100 ... ..9.... ....
0x00060   0803 27BA 0501 0253 0806 2436 0301 0194 ...'..S...6$....
0x00070   0402 268C 0401 01F3 0401 7316 0601 0405 ...&.......s....
0x00080   0000 0000 0000 0000 FFFF FFFF FFFF FFFF ................
0x00090   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000A0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000B0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000C0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000D0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000E0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
```

FFFFFFFFFFFFFFFF
Checksum: 0xD327

DLL : PIC18F6620.dll | OPENING : C:\Développement\RXCAN\Integration_12\rxcan.hex | HW detected

Furthermore all the data related to this selection (memory + configuration bits + ID) are taken into account by the application.

3.7 Upload to PIC

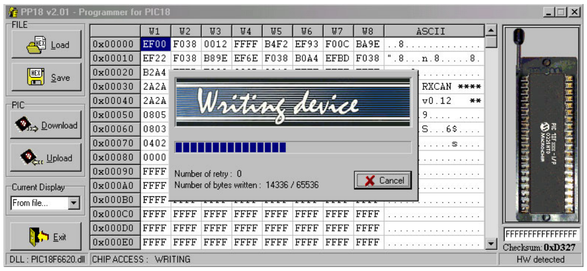
Now that the central grid is filled with the content of the PIC18 memory or the content of an HEX file, all of the buttons located at the left-hand side of the application are enabled.

It is also possible to upload the data displayed in the grid (you can chose the source of this content by selecting the appropriate item in the combo box).

The upload action starts with a non-visible BULK ERASE operation to set the PIC18 into this state:

- All code memory set to 0xFFFF
- Configuration bits set to default values (cf Microchip program specifications)
- ID values are set to 0xFF

Then the upload action proceeds to a WRITE, VERIFY and READ operation, then displays a message to tell you if the upload operation succeeded:



```
          W1   W2   W3   W4   W5   W6   W7   W8   ASCII
0x00000   EF00 F038 0012 FFFF B4F2 EF93 F00C BA9E ..8.............
0x00010   EF22 F038 B89E EF6E F038 B0A4 EFBD F038 ".8...n.8.....8.
0x00020   B2A4                                    ................
0x00030   2A2A                                     RXCAN ****
0x00040   2A2A                                     v0.12   **
0x00050   0805                                    .9.... ....
0x00060   0803                                    .S...6$....
0x00070   0402                                    ......s....
0x00080   0000                                    ...........
0x00090   FFFF                                    ...........
0x000A0   FFFF                                    ...........
0x000B0   FFFF                                    ...........
0x000C0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000D0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000E0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
```

Number of retry : 0
Number of bytes written : 14336 / 65536

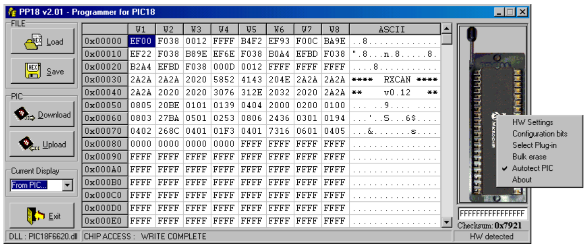
FFFFFFFFFFFFFFFF
Checksum: 0xD327

DLL : PIC18F6620.dll | CHIP ACCESS : WRITING | HW detected

3.8 Popup menu

The popup menu above the ZIF picture gives you more access to the DLL's functionality:

- **HW settings**
- **Configuration bits**
- **Select plug-in**
- **Bulk erase**
- **Autodetect PIC**
- **About**



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```
            W1   W2   W3   W4   W5   W6   W7   W8        ASCII
0x00000   EF00 F038 0012 FFFF B4F2 EF93 F00C BA9E  ..8.............
0x00010   EF22 F038 B89E EF6E F038 B0A4 EFBD F038  ".8...n.8.....8.
0x00020   B2A4 EFBD F038 000D 0012 FFFF FFFF FFFF  ....8...........
0x00030   2A2A 2A2A 2020 5852 4143 204E 2A2A 2A2A  ****   RXCAN ****
0x00040   2A2A 2020 2020 3076 312E 2032 2020 2A2A  **     v0.12   **
0x00050   0805 20BE 0101 0139 0404 2000 0200 0100  ...  ..9....  ....
0x00060   0803 27BA 0501 0253 0806 2436 0301 0194  ...'..S...6$....
0x00070   0402 268C 0401 01F3 0401 7316 0601 0405  ...&.......s....
0x00080   0000 0000 0000 0000 FFFF FFFF FFFF FFFF  ................
0x00090   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF  ................
0x000A0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF  ................
0x000B0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF  ................
0x000C0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF  ................
0x000D0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF  ................
0x000E0   FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF  ................
```

Current Display: From PIC...

FFFFFFFFFFFFFFFF

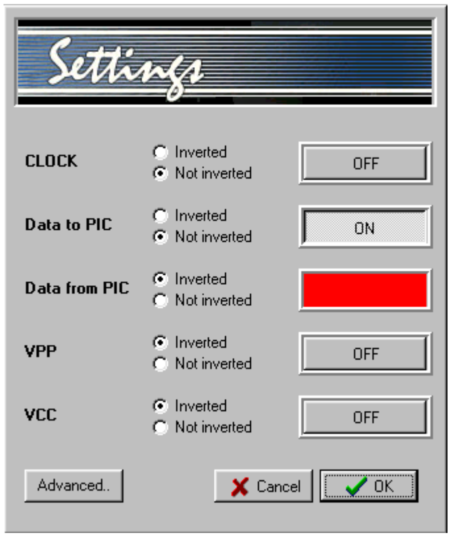
Checksum: 0x7921

DLL : PIC18F6620.dll | CHIP ACCESS : WRITE COMPLETE | HW detected

All these actions are described in the next paragraphs.

3.9 Hardware settings

The settings window offers the ability to setup the hardware but also to test if it is properly connected.



Settings

CLOCK ○ Inverted ● Not inverted OFF

Data to PIC ○ Inverted ● Not inverted ON

Data from PIC ● Inverted ○ Not inverted 🟥

VPP ● Inverted ○ Not inverted OFF

VCC ● Inverted ○ Not inverted OFF

With a SCHAER+ programmer, click on the DATA TO PIC button to send a bit signal to the programmer. Because of a hardware loop located on the programmer printed circuit, you should see the DATA FROM PIC lighted.

The OFF state of any button means the signal is logically at 0 and not physically at 0 in the LPT port. To do so we add a status parameter with 2 possible values:

- **INVERTED**
- **NOT INVERTED**

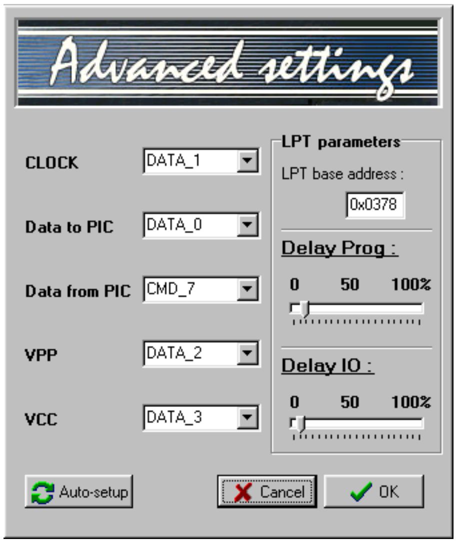
Thanks to the combination of status we are able to read on the programmer the state displayed on the button.

Example: Click on the VPP button. The VPP light on the SCHAER+ board switches ON. Click on the NOT INVERTED VPP status. The light switches OFF. It means a transistor on the programmer probably inverts the signal, so we need to take into account this inversion to properly drive the signal from the panel.

Note: Always configure the status of every signal so that you get a physical "1" on the PIC18 (can be read with a voltmeter).

3.10 Advanced settings

The advanced settings window is for people who want to adapt or build a new hardware programmer. The tested programmer must manage the 5 signals introduced above.



Advanced settings

CLOCK: DATA_1

Data to PIC: DATA_0

Data from PIC: CMD_7

VPP: DATA_2

VCC: DATA_3

LPT parameters

LPT base address : 0x0378

Delay Prog : 0 50 100%

Delay IO : 0 50 100%

The combo boxes permit the user to change the MASK value of each signal. This MASK translates a signal to a bit of the data or command registers of the LPT port.

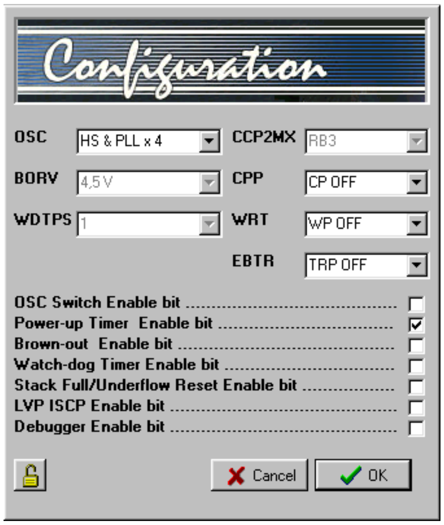
The LPT port number selection is there to specify another LPT address if required.

The Delay_Prog parameter creates a latency time between the WRITE commands sent to the programmer. For 40 pins PIC18 programming a Delay_Prog equal to 10% is sometimes enough. For 28 pins device set a Delay_Prog equal to 40% is necessary. This parameter is tuned automatically by the DLL during the WRITE operation. Set it to 0 to let PP18 find the best value.

The Delay_IO is computed automatically by clicking on the Auto-setup button. That force the DLL to find the small latency necessary to communicate with the chip properly.

3.11 Configuration bits

This window shows you all the configurable bits located in the PIC18 at the addresses beginning at 0x300000.



OSC: HS & PLL x 4
CCP2MX: RB3
BORV: 4,5 V
CPP: CP OFF
WDTPS: 1
WRT: WP OFF
EBTR: TRP OFF

OSC Switch Enable bit .... □
Power-up Timer Enable bit .... ☑
Brown-out Enable bit .... □
Watch-dog Timer Enable bit .... □
Stack Full/Underflow Reset Enable bit .... □
LVP ISCP Enable bit .... □
Debugger Enable bit .... □

The check boxes are used to enable or disable some configuration bits and the combo boxes are used to select the appropriate configuration.

You may notice that every time you load a new HEX file you have to setup the configuration bits once more. To avoid this click on the locker button. It freezes all the configuration bits so that you can update your PIC18 faster by just loading a file and uploading it to the PIC without any configuration setup.

About CODE PROTECTION:

Not all the possible configurations are represented here. For instance, if you want to lock the boot block AND the 4th panel in memory, you have to lock all the memory.

3.12 Select plug-in

Described at the beginning of the chapter.

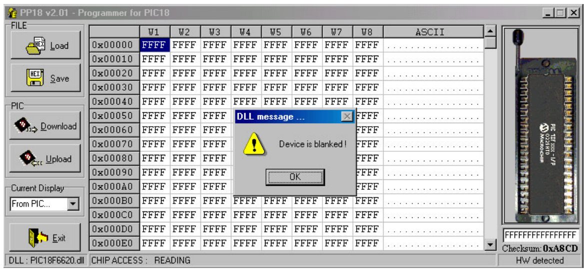
3.13 Bulk erase

The BULK ERASE operation sets the PIC18 into this state:

- All code memory set to 0xFFFF
- Configuration bits set to default (cf Microchip program specifications)

The BULK ERASE action is followed by a DOWNLOAD action to check if the chip is really erased or not.

So after erasing the PIC18 you have to obtain the window:



Device is blanked !

```
         W1   W2   W3   W4   W5   W6   W7   W8   ASCII
0x00000  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x00010  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x00020  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x00030  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x00040  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x00050  FFFF FFFF FFFF                     FFFF ................
0x00060  FFFF FFFF FFFF                     FFFF ................
0x00070  FFFF FFFF FFFF                     FFFF ................
0x00080  FFFF FFFF FFFF                     FFFF ................
0x00090  FFFF FFFF FFFF                     FFFF ................
0x000A0  FFFF FFFF FFFF                     FFFF ................
0x000B0  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000C0  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000D0  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000E0  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
```

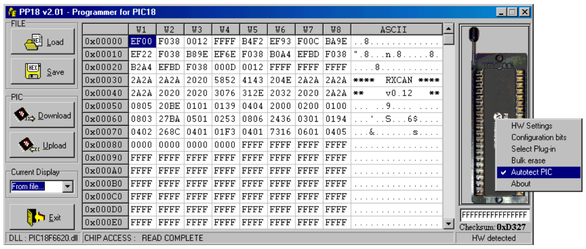
FFFFFFFFFFFFFFFF
Checksum: 0xA8CD

DLL : PIC18F6620.dll | CHIP ACCESS : READING | HW detected

Click on the OK button to close the message box and continue your job.

3.14 PIC autodetection

By default the application is scanning the programmer every 500 ms to detect the presence of the PIC18 specified by the DLL. If the expected PIC18 is inserted into the programmer the application displays a ZIF with a generic PIC18Fxxx chip on it:



```
         W1   W2   W3   W4   W5   W6   W7   W8   ASCII
0x00000  EF00 F038 0012 FFFF B4F2 EF93 F00C BA9E ..8.............
0x00010  EF22 F038 B89E EF6E F038 B0A4 EFBD F038 ".8...n.8.....8.
0x00020  B2A4 EFBD F038 000D 0012 FFFF FFFF FFFF ....8...........
0x00030  2A2A 2A2A 2020 5852 4143 204E 2A2A 2A2A ****  RXCAN ****
0x00040  2A2A 2020 2020 3076 312E 2032 2020 2A2A **     v0.12   **
0x00050  0805 20BE 0101 0139 0404 2000 0200 0100 ... ..9.... ....
0x00060  0803 27BA 0501 0253 0806 2436 0301 0194 ...'..S...6$....
0x00070  0402 268C 0401 01F3 0401 7316 0601 0405 ...&.......s....
0x00080  0000 0000 0000 0000 FFFF FFFF FFFF FFFF ................
0x00090  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000A0  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000B0  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000C0  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000D0  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
0x000E0  FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF ................
```

FFFFFFFFFFFFFFFF
Checksum: 0xD327

DLL : PIC18F6620.dll | CHIP ACCESS : READ COMPLETE | HW detected

Click on the AUTODETECT PIC item to disable it. Click again to re-enable it.

3.15 About the application

The ABOUT item displays the splash screen of the application. It is the only item to be dependant on the main application, not of the DLL.

PP18 - Programmer for PIC18
Release 2.01
Distributed under GPL license
xavier.montagne@wanadoo.fr

4 Device migration

This chapter describes how to proceed to port the DLL sources in order to program other chips (PIC18, PIC16, etc).

4.1 Requirements

The DLL sources are included in the ZIP file of the PP18 sources. The related project is a Borland Builder 5.0 project. Open the “PIC18F452.bpr” to view all the sources attached to the project.

You are not forced to develop with Borland Builder IDE just because PP18 expects a Windows DLL. You can develop of course with Microsoft Visual Studio IDE provided that you respect the interface between PP18 and the DLL (file DLL_interface.c).

4.2 DLL architecture overview

The DLL sources included in the PP18 sources are related to the PIC18F452 Microchip device.

The Borland Builder project includes the following files:

PIC18F452.bpr	Builder project
PIC18F452.res	Resources file
P18F452.cpp	DLL entry function
DLL_interface.c	Interface function list
DLL_interface.h	Interface header file
Com.c	Manage data from FILE or PIC
Com.h	Com header file
Driver.c	Programmer driver
Driver.h	Programmer driver header file
DLLAbout.cpp	Show the “About” window
DLLAbout.h	“About” window header file
DLLAbout.dfm	Specific B. Builder file
Settings.cpp	Show the “Settings” window
Settings.h	“Settings” window header file
Settings.dfm	Specific B. Builder file
Configuration.cpp	Show the “Config” window
Configuration.h	“Config” window header file
Configuration.dfm	Specific B. Builder file
Advanced.cpp	Show the “Advanced” window
Advanced.h	“Advanced” window header file
Advanced.dfm	Specific B. Builder file

4.3 DLL interface

The interface with the main application is described in the DLL_interface.h file.

The content of the interface is presented in the **Appendix A “Interface in-between PP18 and DLL”**.

You have to respect this interface to be sure PP18 will be able to respond to all the actions of the user.

The DLL is responsible for detecting the presence of the PIC18 on the hardware programmer. This is done through the `ReadRevDev` function by sending a request periodically to read the **REV** or **DEV** field of the PIC inserted. Have a look at the **Appendix B**.

4.4 Customising DLL

The core of the DLL itself is split into 2 parts:

- Com.c: this file contains all the code related to the HEX parser, the procedures to read or write the PIC18 and some additional functions to initialise or test the hardware.

- Driver.c: this file contains all the very low level code to program or read the different parts of the PIC18 memories. It is includes the definitions of both of the Macros describing the way the data are sent to the LPT port.

So to port the DLL to a new PIC architecture like PIC16 for instance, you have to adapt the code of Driver.c file to respect the Microchip specifications. These specifications are regrouped in a specific document as nominated in the Documentation chapter.

Have a look at the **Appendix C “Example to program a PIC18Fxxx device”** and the Microchip programming specifications to understand better how to write your code.

4.5 Validation test plan

At the end of the Microchip programming specifications, you can find an example of checksum computation for typical content of memories (code + configuration bits + ID).

First check that you always find what is indicated by Microchip, and then try to drive your hardware signal by signal. Finally you’re ready to access the chip.

5 Hardware migration

This chapter describes how to setup PP18 to use another kind of programmer (SCHAER, JDM, etc).

5.1 Customising hardware

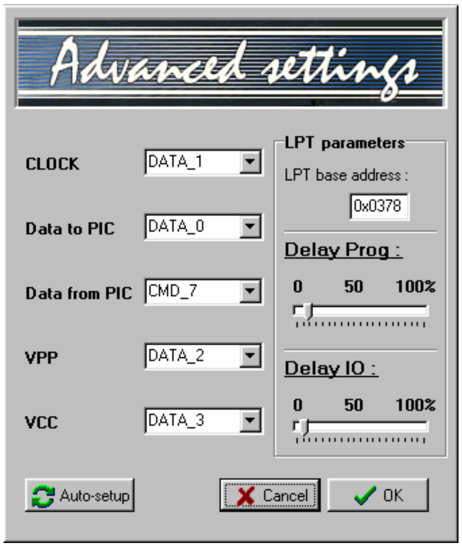
PP18 has been designed to communicate with a PIC18 device via 5 signals:

- **MCLR /VPP:** enable access to the chip
- **VCC:** power on/off the chip
- **DATA TO PIC:** send a bit to the chip
- **DATA FROM PIC:** read a bit from the chip
- **CLOCK:** enable read/write of each bit

These 5 signals are mandatory by Microchip ICSP programming specification.

PP18 manages these 5 signals through the parallel port (LPT). The "**DATA FROM PIC**" signal is a bit from the command register of the LPT port, the other signals are bits of the data register of LPT port.

If you're used to programming your chip with another programmer than a SCHAER type one, then it is possible to customize the position of these signals in the LPT registers. You can easily do it from the ADVANCED window of the DLL:



CLOCK: DATA_1
Data to PIC: DATA_0
Data from PIC: CMD_7
VPP: DATA_2
VCC: DATA_3

LPT parameters
LPT base address : 0x0378
Delay Prog : 0 50 100%
Delay IO : 0 50 100%

This panel allows the user to setup the LPT port, but doesn't provide a way to modify the transfer protocol or to change of COM type (serial, USB, fibre, etc).

Click on the OK button to validate your new settings or the CANCEL button to abort. If the new settings are not possible on a LPT port (2 signals are using the same value for instance), a message box will appear.

Take care to choose a correct value for every signal. Only the "**DATA FROM PIC**" signal is an input (PC view), the others are outputs. If you setup wrong values, the chip won't be detected (the ZIF image remains empty).

5.2 Developing with a new peripheral

If you want to access the hardware through a different hardware interface than the LPT port, so you have to modify both of the Macros dedicated to the transfer to the LPT port.

The details of the code are presented in **Appendix D "MACRO definitions to access LPT port"**.

Of course if you want to use a block oriented peripheral like USB you'll have to rebuild the entire Driver.c file. Indeed the actual file is dedicated to character-oriented device (LPT port)…

An interface like USB would greatly increase the global performance of the data transfer and also would allow programming the PIC18 under 5V only, without any external power supply, just by using the 5V provided by the USB connection.

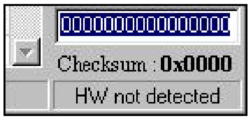
6 Troubleshooting

This chapter presents all the troubles you can encounter using PP18 with SCHAER+ or your own hardware, and also how to solve them.

6.1 Hardware not detected

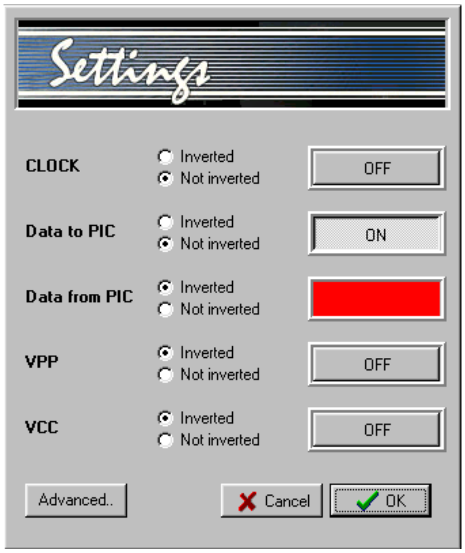
The first step to program a PIC18 with PP18 is to correctly detect the programmer itself.

If you don't succeed to detect any hardware you should have:



0000000000000000
Checksum : 0x0000
HW not detected

Open the hardware settings windows to test your hardware:



Settings

CLOCK ○ Inverted ● Not inverted OFF
Data to PIC ○ Inverted ● Not inverted ON
Data from PIC ● Inverted ○ Not inverted 🟥
VPP ● Inverted ○ Not inverted OFF
VCC ● Inverted ○ Not inverted OFF

Click on the "**Data to PIC**" button and check you have physically a "1" at the dedicated PIC18 pin (RB7 for instance).

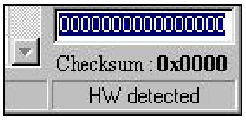
Once you find a "1" on your board, check the colour of the "Data from PIC" button. It shows if the hardware is detected or not by the PP18 software. If it's **RED** the hardware is detected, if not change the "Inverted / Not Inverted" property.

If you're failed verify the following points:

- check the hardware is powered on
- click on the "Inverted / Not inverted" radio buttons to invert the signal if necessary
- check the LPT cable
- check you LPT port address is correct (open the Advanced Settings window)
- check the signal on the LPT connector itself (to find any hardware problem…)

To detect the hardware PP18 just uses the data loop on the 7407 chip. It sends a logical "1" on "**Data to PIC**" and expect a logical "1" on the "**Data from PIC**" signal.

When you solve the hardware problem you should have an "HW detected" in the status bar of PP18:



0000000000000000
Checksum : 0x0000
HW detected

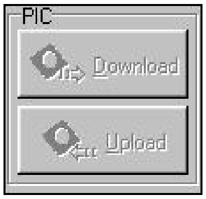
6.2 PIC not detected

Every 500 ms PP18 try to detect the presence of any PIC18 inserted in the programmer.

To do so it sends a request to the hardware in order to read the REV / DEV fields of configuration bits. If the result is all bits at "1" then there is no chip inserted.

If a value is detected it is compared to the one expected by the DLL. Only the expected PIC18 will be recognised by the DLL.

If the chip is not detected by PP18 the DOWNLOAD and UPLOAD buttons are disabled:



Check first you're using the DLL dedicated to your PIC18 !

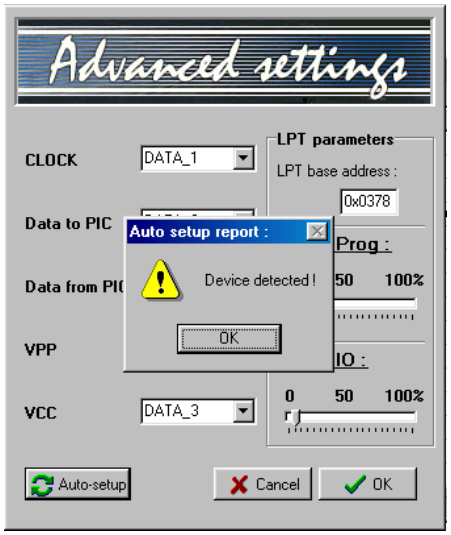
If you're using the appropriate DLL then check the VPP led (the closest of the ZIF socket on SCHAER+ programmer) is blinking twice per second.

Then check the CLOCK and VCC signals from the SETTINGS window in order to be sure the correct tension is applied on your PIC18.

Now we suppose the hardware settings are correct (use Settings window). If the device is still not detected then you should open the Advanced Settings window to tune the communication transfer rate.

To detect the PIC18 properly the Delay_IO parameter is not involved. In fact it's only used to write data into the flash correctly.

Click now on the AUTO-SETUP button to let PP18 find the best Delay_Prog parameter for your computer. This parameter is a delay inserted in every CLOCK change to let the PIC18 enough time to understand the requests.



CLOCK DATA_1

VCC DATA_3

LPT base address : 0x0378

Auto setup report :

Device detected !

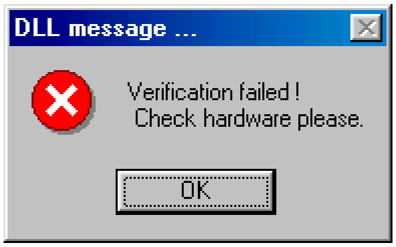
OK

PP18 should find the PIC18 inserted and the smallest Delay_IO value to speed up the transfer to the chip.

If PP18 does not succeed to find any chip, check your hardware (GND signal connected to the LPT connector, any hardware shortcuts, PIC18 socket,…).

6.3 PIC18 is bad programmed

After programming the device you can get a such message:



DLL message ...

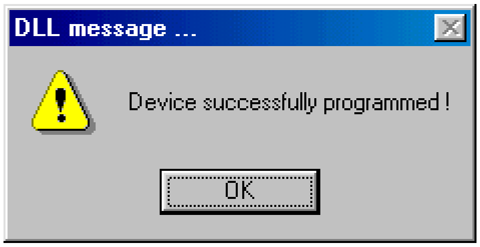
Verification failed !
Check hardware please.

OK

This means PP18 succeeds to communicate with the PIC18 inserted but when it verifies the content of the written memory the check action failed.

With the 2.01 version of PP18 you don't have to modify the Delay_Prog parameter. This value lets more time to the chip to write data into the flash memory. An automatic retry is forced by the PP18 DLL in order to tune the best Delay_Prog for your hardware and your PIC18.

Then if the transfer failed your chip is probably dead. Try with another chip and you should have this message:



DLL message ...

Device successfully programmed !

OK

To speed up the PP18 transfer to the chip change the resistor connected to the DATA pin of the PIC18 in your programmer. The smaller is the resistor the faster is the transfer to the PIC18.

Value less than 1 Kohm may not be used in a SCHAER+ like programmer.

7 Revision history

Rev 1.00 - Spetember 2003 :

Initial release.

8 Related documentations

- ✓ **Programming for PIC18Fxx2/PIC18Fxx8 Flash MCUs**

  Ref: DS39576A

- ✓ **Programming for PIC18Fx220/PIC18Fx320 Flash MCUs**

  Ref: DS39592B

- ✓ **PIC18Fxx2 Data Sheet**

  Ref: DS39564A

9 Contacts and maintainers

For any question concerning PP18 or SCHAER+ programmers you can contact the following persons:

✓ Xavier MONTAGNE

xavier.montagne@wanadoo.fr

10 Appendices

10.1 Interface between PP18 and DLL

```
/**********************************************************************/
/*                                                                    */
/* File name: DLL_interface.h                                         */
/*                                                                    */
/* Since:     2002/12/03                                              */
/*                                                                    */
/* Version:   1.0                                                     */
/*                                                                    */
/* Author:    MONTAGNE Xavier [XM] {link xavier.montagne@wanadoo.fr}  */
/*                                                                    */
/* Purpose: Offer high level interface for PIC programming operations:*/
/*          parsing or creat an HEX file, updating the PIC structures */
/*          after parsing, reading or programming the PIC,...         */
/*                                                                    */
/* Distribution: This file is part of PP18.                           */
/*               PP18 is free software; you can redistribute it       */
/*               and/or modify it under the terms of the GNU General  */
/*               Public License as published by the Free Software     */
/*               Foundation; either version 2, or (at your option)    */
/*               any later version.                                   */
/*                                                                    */
/*               PP18 is distributed in the hope that it will be      */
/*               useful, but WITHOUT ANY WARRANTY; without even the   */
/*               implied warranty of MERCHANTABILITY or FITNESS FOR A */
/*               PARTICULAR PURPOSE.  See the GNU General Public      */
/*               License for more details.                            */
/*                                                                    */
/*               You should have received a copy of the GNU General   */
/*               Public License along with PP18; see the file         */
/*               COPYING.txt. If not, write to the Free Software      */
/*               Foundation, 59 Temple Place - Suite 330,             */
/*               Boston, MA 02111-1307, USA.                          */
/*                                                                    */
/* History:                                                           */
/*      2002/12/03  [XM] Create this file                             */
/*                                                                    */
/**********************************************************************/

#if !defined(__DLL_INTERFACE_H__)
#define __DLL_INTERFACE_H__

/***********************************************************************
 * INCLUDES
 **********************************************************************/
#include <windows.h>
#include "com.h"

/***********************************************************************
 * DEFINES
 **********************************************************************/
#define FromPIC                1
#define FromFile               0

#define DLL_EXPORT             __declspec(dllexport)

/***********************************************************************
```

```
 * FUNCTION DEFINITIONS
 ***********************************************************************/
#if defined(__cplusplus)
extern "C"
{
#endif

/************************************************************************
 * Only fill the SHexFile structure. Do not proceed to any programming
 * sequences. This function fills the Hex_from_file structure, so it has
 * to be called first to initialyze.
 *
 * @param  char *ucFilename   IN  HEX filename to parse
 * @return Status_t               FILE_ERROR if something wrong appends
 *                                (Hex larger than PIC memory size)
 *                                ALL_RIGHT otherwise
 ***********************************************************************/
Status_t DLL_EXPORT ParseFile(char *ucFilename);

/************************************************************************
 * Give the memory size of the chip (and not the memory size of usefull
 * data inside the PIC), or the data size of the HEX file parsed.
 *
 * @param  u_int *uiSize      OUT PIC memory size
 * @param  u_int uiFrom       IN  Flag (PIC or File)
 * @return Status_t               Always ALL_RIGHT
 ***********************************************************************/
Status_t DLL_EXPORT GetMemorySize(unsigned int *uiSize, unsigned int uiFrom);

/************************************************************************
 * Copy the memory content from the PIC or FILE structure to the buffer
 * parameter.
 *
 * @param  u_short *usMemory  OUT Memory buffer
 * @param  u_int uiFrom       IN  Flag (PIC or File)
 * @return Status_t               Always ALL_RIGHT
 ***********************************************************************/
Status_t DLL_EXPORT GetMemoryBuffer(unsigned short *usMemory, unsigned int uiFrom);

/************************************************************************
 * Copy the memory content from the buffer to the PIC or FILE structure.
 *
 * @param  u_short *usMemory  IN  Memory buffer
 * @param  u_int uiFrom       IN  Flag (PIC or File)
 * @return Status_t               Always ALL_RIGHT
 ***********************************************************************/
Status_t DLL_EXPORT SetMemoryBuffer(unsigned short *usMemory, unsigned int uiFrom);

/************************************************************************
 * Rebuil a HEX File from memory, config and ID. Do not proceed to any
 * programming sequences. This function creats a new HEX file a replace
 * an existing one.
 *
 * @param  char *ucFilename   IN  HEX filename to build
 * @param  u_int uiFrom       IN  Flag (PIC or File)
 * @return Status_t               FILE_ERROR if something wrong appends
 *                                (cannot creat a new file)
 *                                ALL_RIGHT otherwise
 ***********************************************************************/
Status_t DLL_EXPORT UnParseFile(char *ucFilename, unsigned int uiFrom);

/************************************************************************
 * Perform a programmation process to the hardware programmer and the
 * chip on it concerning memory area only.
 *
 * @param  u_int uiFrom      IN  Flag (PIC or File)
 * @return Status_t              BAD_PROGRAMMED if something wrong appends
 *                               PROGRAMMED if not
 *                               ALL_RIGHT otherwise
 **********************************************************************/
Status_t DLL_EXPORT ProgramMem(unsigned int uiFrom);

/***********************************************************************
 * Perform a programmation process to the hardware programmer and the
 * chip on it concerning config area only.
 *
 * @param  u_int uiFrom      IN  Flag (PIC or File)
 * @return Status_t              BAD_PROGRAMMED if something wrong appends
 *                               PROGRAMMED if not
 *                               ALL_RIGHT otherwise
 **********************************************************************/
Status_t DLL_EXPORT ProgramConfig(unsigned int uiFrom);

/***********************************************************************
 * Perform a programmation process to the hardware programmer and the
 * chip on it concerning ID area only.
 *
 * @param  u_int uiFrom      IN  Flag (PIC or File)
 * @return Status_t              BAD_PROGRAMMED if something wrong appends
 *                               PROGRAMMED if not
 *                               ALL_RIGHT otherwise
 **********************************************************************/
Status_t DLL_EXPORT ProgramID(unsigned int uiFrom);

/***********************************************************************
 * Download the code memory field from the PIC device, and update the
 * PIC structure.
 *
 * @param  void
 * @return Status_t                BLANK if all memory set to 0xFFFF
 *                                 NOT_BLANK if not
 *                                 ALL_RIGHT otherwise
 **********************************************************************/
Status_t DLL_EXPORT ReadMem(void);

/***********************************************************************
 * Download the config field from the PIC device, and update the PIC
 * structure.
 *
 * @param  void
 * @return Status_t                LOCKED if Code Prection ON
 *                                 ALL_RIGHT otherwise
 **********************************************************************/
Status_t DLL_EXPORT ReadConfig(void);

/***********************************************************************
 * Download the ID field from the PIC device, and update the PIC
 * structure.
 *
 * @param  void
 * @return Status_t                Always ALL_RIGHT
 **********************************************************************/
Status_t DLL_EXPORT ReadID(void);

/***********************************************************************
 * Download REV+DEV from the chip present in the device chip.
 * This function fills the Hex_from_file structure, so it has
 * to be called first to initialyze the PIC structure.
 *
 * @param  char *PICname      IN  PIC name reference (name of DLL)
 * @return Status_t               PIC_DETECTED if right PIC detected
 *                                HARDWARE_ERROR if not detected
 **********************************************************************/
Status_t DLL_EXPORT ReadRevDev(char *PICname);

/***********************************************************************
 * Get the ID field of the structure specify by uiFrom with the ucValue.
 * The field is 8 bytes long, so just the byte specified by ucIndex is
 * modified.
 *
 * @param  u_char *ucValue     IN  Value of the ID to get at ucIndex pos
 * @param  u_char ucIndex      IN  Index of the ID to get
 * @param  u_int uiFrom        IN  Flag (PIC or File)
 * @return Status_t                Always ALL_RIGHT
 **********************************************************************/
Status_t DLL_EXPORT GetIDValue(unsigned char *ucValue, unsigned char ucIndex, unsigned
int uiFrom);

/***********************************************************************
 * Fill the ID field of the structure specify by uiFrom with the ucValue.
 * The field is 8 bytes long, so just the byte specified by ucIndex is
 * modified.
 *
 * @param  u_char ucValue      IN  Value of the ID to set at ucIndex pos
 * @param  u_char ucIndex      IN  Index of the ID to set
 * @param  u_int uiFrom        IN  Flag (PIC or File)
 * @return Status_t                Always ALL_RIGHT
 **********************************************************************/
Status_t DLL_EXPORT SetIDValue(unsigned char ucValue, unsigned char ucIndex, unsigned
int uiFrom);

/***********************************************************************
 * Extract the checksum info from every line of an INTEL HEX file.
 * Compare it with the value computed by the HEX parser.
 *
 * @param  u_short *usChecksum IN  Reference to the checksum computed
 * @param  u_int uiFrom        IN  Flag (PIC or File)
 * @return Status_t                Always ALL_RIGHT
 **********************************************************************/
Status_t DLL_EXPORT ComputeGeneralChecksum(unsigned short *usChecksum, unsigned int
uiFrom);

/***********************************************************************
 * Check the presence of a programmer on LPT port.
 * Hardware present if DATA_FROM_PIC == DATA_TO_PIC[0 or 1]
 *
 * @param  void
 * @return Status_t                ALL_RIGHT if hardware present
 *                                 HARDWARE_ERROR if not present
 **********************************************************************/
Status_t DLL_EXPORT IsHWPresent(void);

/***********************************************************************
 * Stuck at 0 all of the signals (logical 0, not necessarily physical 0).
 *
 * @param  void
 * @return Status_t                Always ALL_RIGHT
 **********************************************************************/
Status_t DLL_EXPORT InitHardware(void);
```

```
/***********************************************************************
 * Stuck at 1 the VCC signal (logical 1, not necessarily physical 1).
 *
 * @param  void
 * @return Status_t                Always ALL_RIGHT
 **********************************************************************/
Status_t DLL_EXPORT PowerOn(void);

/***********************************************************************
 * Stuck at 0 the VCC signal (logical 0, not necessarily physical 0).
 *
 * @param  void
 * @return Status_t                Always ALL_RIGHT
 **********************************************************************/
Status_t DLL_EXPORT PowerOff(void);

/***********************************************************************
 * About window of the DLL.
 * Catch the HWND handle of the application.
 *
 * @param  HWND hWnd           IN  Handle of the main window
 * @return Status_t                Always ALL_RIGHT
 **********************************************************************/
Status_t DLL_EXPORT ShowDLL(HWND hWnd);

/***********************************************************************
 * Show Settings window.
 *
 * @param  HWND hWnd           IN  Handle of the main window
 * @return Status_t                Always ALL_RIGHT
 **********************************************************************/
Status_t DLL_EXPORT ShowSettings(HWND hWnd);

/***********************************************************************
 * Display the "Config" window of the DLL.
 *
 * @param  HWND hWnd           IN  Handle of the main window
 * @return Status_t                Always ALL_RIGHT
 **********************************************************************/
Status_t DLL_EXPORT ShowConfig(HWND hWnd, unsigned int uiFrom);

/***********************************************************************
 * Erase all the programmable bits of the PIC18.
 *
 * @param  HWND hWnd           IN  Handle of the main window
 * @return Status_t                Always ALL_RIGHT
 **********************************************************************/
Status_t DLL_EXPORT DoBulkErase(HWND hWnd);

#if defined(__cplusplus)
}
#endif

#endif /* __DLL_INTERFACE_H__ */

/* End of File */
```

10.2 First access to the chip inserted (example for PIC18F458)

```
/**********************************************************************
 * Download REV+DEV from the chip present in the device chip.
 * This function fills the Hex_from_file structure, so it has
 * to be called first to initialyze the PIC structure.
 *
 * @param  char *PICname      IN  PIC name reference (name of DLL)
 * @return Status_t               PIC_DETECTED if right PIC detected
 *                                HARDWARE_ERROR if not detected
*********************************************************************/
Status_t DLL_EXPORT ReadRevDev(char *PICname)
{
  pHexFile_t p_hfFile;
  pStatistic_t p_Stat;
  unsigned short usWord, usRev, usDev;
  static unsigned int uiDetected = 0;
  char thePICname[10] = "PIC18F458";

  p_hfFile = &HEX_from_PIC;
  p_Stat = &Stat;
  p_hfFile->SChipStatus = 0;

  ReadBlock(0x3FFFFE, &usWord, 1);
  usRev =   usWord & 0x1F;
  usDev = ((usWord & 0xE0) >> 5) + ((usWord & 0xFF00) >> 5);

  if (usRev == 0x1F)
        p_hfFile->SChipStatus = 8;

  if ((usDev & 0x07FF) == 0x43)
  {
    p_hfFile->SChipStatus = 7;
    if (uiDetected == 0)
    {
      p_hfFile->pusMemory = &MemPIC[0];
      p_hfFile->pConfig = &CFG_PIC;
      p_hfFile->uiMemorySize = _MAX_PIC_SIZE;
      memset(p_hfFile->pusMemory, 0xFF, p_hfFile->uiMemorySize * sizeof(unsigned
short));
      memset(p_hfFile->pConfig, 0xFF, sizeof(pConfigWord_t));
      memset(p_hfFile->szIdValue, 0xFF, 8);
      p_hfFile->pConfig->szRev = (unsigned char)(usRev);
      p_hfFile->pConfig->usDev = usDev;
      strcpy(PICname, thePICname);
      uiDetected = 1;
    }
  }
//  else
//    uiDetected = 0;

  return(p_hfFile->SChipStatus);
}
```

10.3 Example to program a PIC18Fxxx device

```
/*********************************************************************
 * Write a buffer into the memory of the PIC.
 * A programmable delay exists to avoid any transfert problem with
 * low speed communication PIC. Full speed is default speed.
 *
 * @param  u_int  adr            IN  Start address in the PIC address
 * @param  u_short *block        IN  Buffer start address
 * @param  u_int size            IN  Number of SHORT to write
 * @param  u_int *try_done       IN  For compatibility with JW version
 * @param  u_int word_programmed IN  Number of SHORT programmed
 * @return void
 ********************************************************************/
void ProgramBlock(unsigned int adr, unsigned short *block, unsigned int size, unsigned
int *try_done, unsigned int *word_programmed)
{
  unsigned int i, j, word_prg;
  unsigned short value;

  SetBit(PL_VPP);

  /* Precharge phase */
  SetTBLPTR(0x3C0006);
  WriteDataAtTBLPTR(0x00, NO_CHANGE);
  WriteOpNOP();
  WriteData((unsigned short)(0x8EA6));
  WriteOpNOP();
  WriteData((unsigned short)(0x9CA6));
  /* End fo Precharge phase */

  word_prg  = 0;
  SetTBLPTR(adr);

  for (i = 0; i < size; i = i + 1)
  {
       value = *block;

       for (j = 0; (j < 3) & (size > 1); j++)
       {
              WriteDataAtTBLPTR(value, POST_INC);
              i++;
              block++;
              word_prg++;
              value = *block;
       }
       WriteDataAtTBLPTR(value, PRE_INC);
       WriteOpDelay(0x00);
       for (j = 0; j < delay_IO; j++)
              SetBit(PL_CLOCK);
       ClearBit(PL_CLOCK);
       WriteData(0x0000);

       WriteDataAtTBLPTR(0x0000, POST_INC);

       block++;
       word_prg++;
  }
  *try_done = i;
  *word_programmed = word_prg;

  ClearBit(PL_VPP);
}
```

D – MACRO definitions to access the LPT port

```
#ifdef LINUX

#include <sys/io.h>
#define pport_in(value, port_adr)    value = inb(port_adr)
#define pport_out(value, port_adr)      outb(value, port_adr)

#else

  #ifdef WITHOUT_PIC

  #include <stdlib.h>
  #include <stdio.h>
  #define pport_in(value, port_adr)     value = (rand())%0xFF;
  #define pport_out(value, port_adr)

  #else

  #define pport_in(value, port_adr)       __asm  mov dx, port_adr ;\
                                          __asm  in  al, dx ;\
                                          __asm  mov value, al

  #define pport_out(value, port_adr)      __asm  mov dx, port_adr ;\
                                               __asm  mov al, value ;\
                                          __asm  out dx, al

  #endif /* WITHOUT_PIC */

#endif /* LINUX */
```